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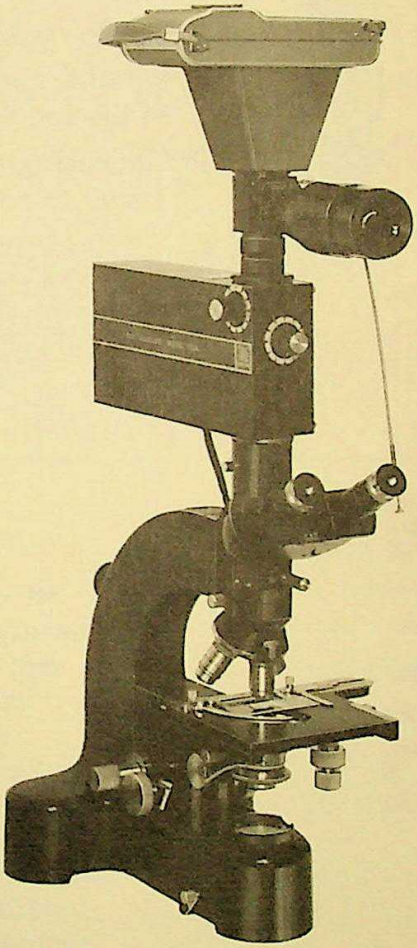


model 513

biolaser system

TRG® LASER PRODUCTS FOR SCIENCE, INDUSTRY, DEFENSE

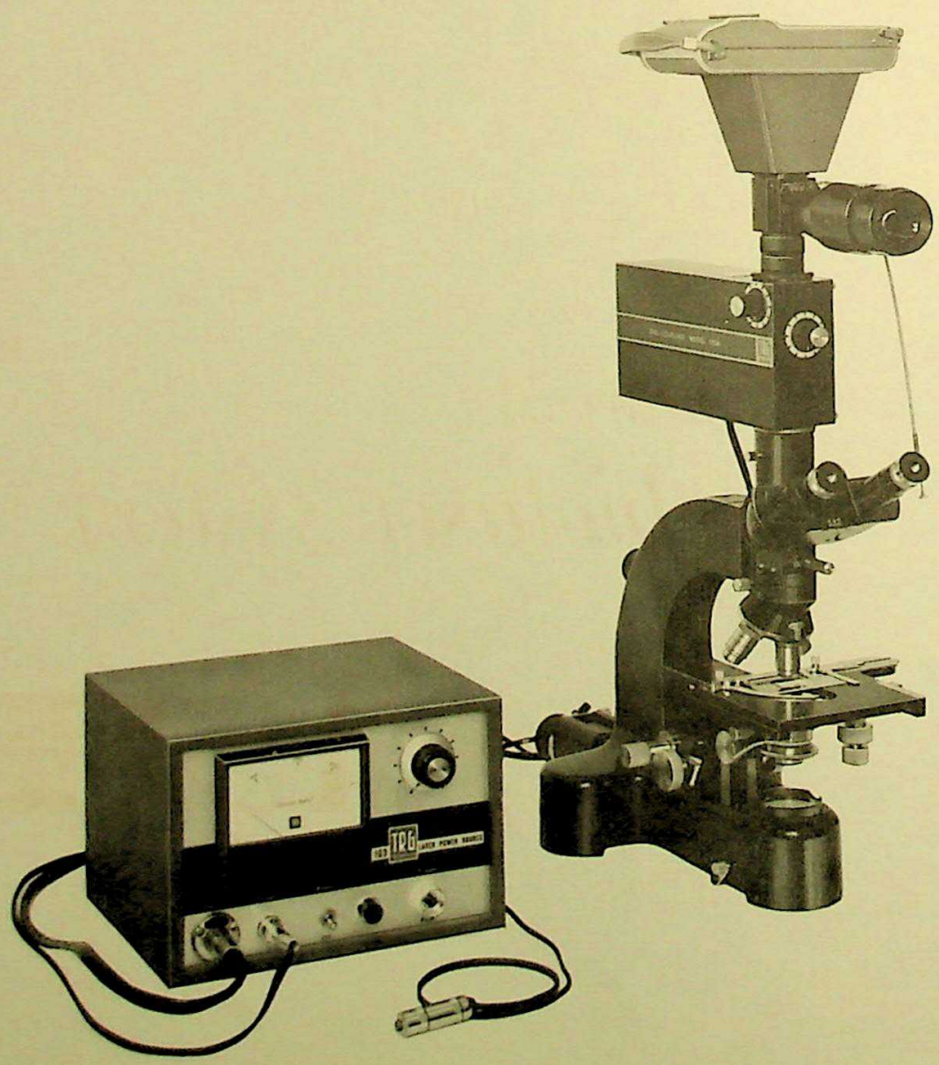
CONTROL DATA CORPORATION

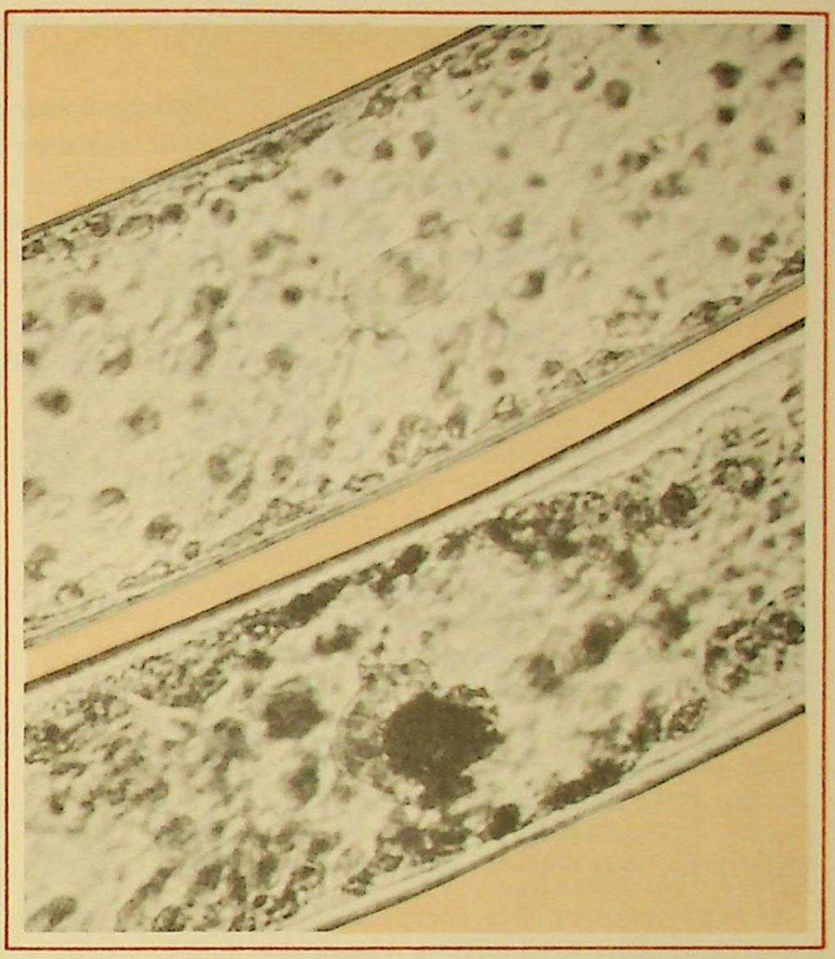
359/363

RGA

MODEL 513 biolaser system

- Can be focused to spot sizes as small as one micron.
- A flux density on stage is provided up to 10^4 joules/cm^2.
- Simple x-y controls permit precise spot positioning.
- Can be triggered remotely or by panel push-button.
- Permits simultaneous photography and microirradiation of the specimen.
- Cinemicrography, time-lapse photography, and closed-circuit television techniques can be applied.





Alga cell (Spirogyra) before and after microirradiation of nucleus. (The microirradiation caused no damage to the cell walls.)

The TRG Model 513 Biolaser is a complete, practical, working system for biological and biomedical research using laser techniques. This new instrument contains a controlled high-intensity monochromatic source of energy that produces an ultra-narrow coherent light beam which can be conveniently focused through the microscope to spot sizes as small as ONE micron. The Biolaser is ready to use by simply plugging it into a 115-volt AC outlet without adding auxiliary instrumentation. Researchers now have an easy-to-operate, easy-to-set-up instrument capable of severing cellular bodies with more elegant techniques than those afforded by micromanipulation methods. Adapters are available to permit simultaneous photography and irradiation of the specimen. Cinemicrography, time-lapse photography, and closed-circuit television techniques can be applied to broaden the instrument's capabilities as a research tool.

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The 513 can be used in a wide range of scientific and biomedical applications such as:

- Laser microirradiation of biological specimens.
- Interaction of electromagnetic radiation with biological systems.
- Studies on the molecular level of cellular components and isolated cells.
- Irradiation of blood group substances, enzymes, and plasma proteins.
- Selective destruction or alteration of cell components.
- Irradiation of tissue cultures.
- Microsurgical applications to provide openings in cell walls with much greater accuracy and ease than is possible with micromanipulation.

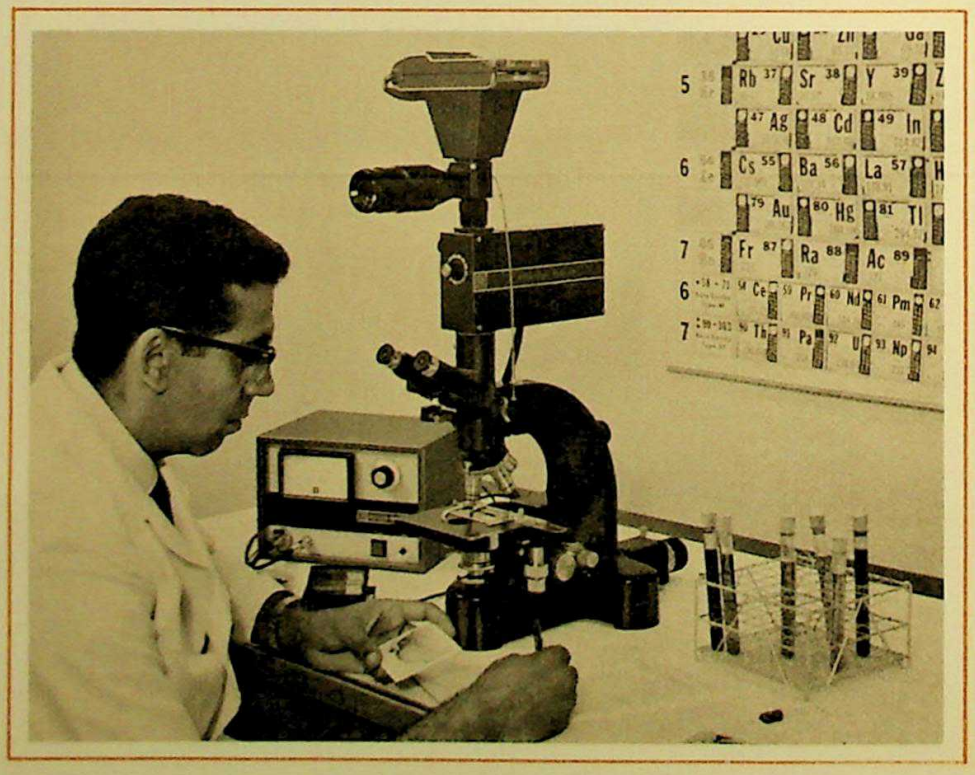
By means of the simple X-Y controls, the 513 permits precise positioning of the laser beam on the specimen. The laser spot size incident upon the specimen is varied by changing the power of the microscope objectives. The greater the magnification, the smaller the focused spot. Spot size can also be controlled by means of the interchangeable apertures supplied with the unit.

A great number of new experiments have been reported using laser techniques in biological research. Many of these appear to be developing rapidly from theoretical concepts to functional techniques. Your research in biological or biomedical investigations will be advanced by the introduction of the new laser technique. Our representative will welcome the opportunity to discuss your application with you.

Other new possibilities for Biolasers in current research and development are:

- Micrometallurgical analysis under high magnification.
- Photography of fast-moving organisms.
- Spectroscopic studies of very small regions of biological interest.

applications



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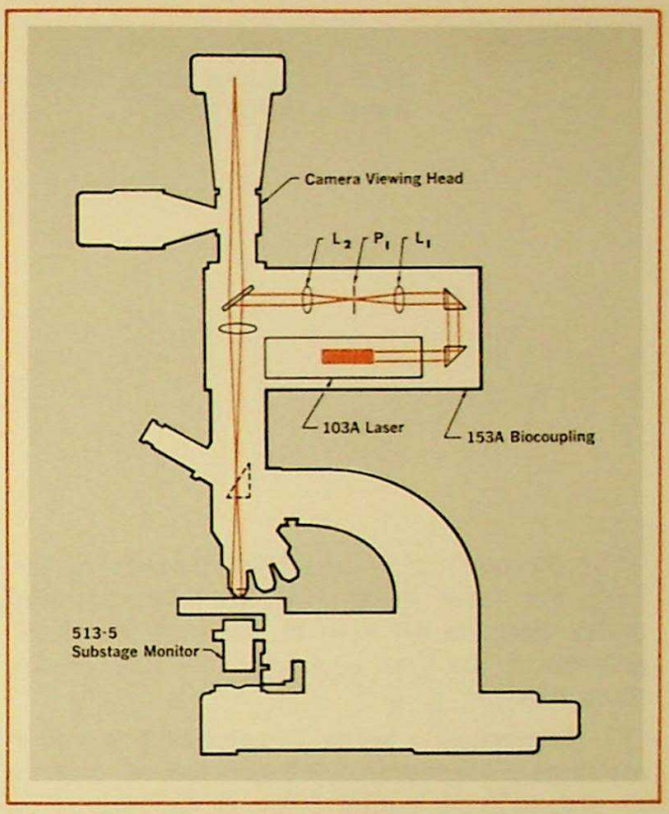

Functional diagram of Model 513 Biolaser system.

The 513 Biolaser combines a low-power laser system with the optics and easy handling capabilities of a high-quality research microscope. The principles of microscopy apply to the coherent light beam from the laser head as well as the incoherent, transmitted light from the microscope base. The coarse and fine focusing adjustments of the object stage of the microscope automatically focus the laser beam to the primary image plane of the microscope.

The basic system consists of the following units:

153A	Biocoupling
103A	Laser Head
103A	Power Supply
	Leitz Ortholux Microscope — not supplied. (Can be adapted for other microscopes on request.)

The following components are also available as accessories:

153A-5	Camera Adapter
513-4	Safety Interlock
513-5	Substage Energy Monitor
102	Energy Meter

The laser is easily coupled to the microscope, without extensive alignment, and is ready for use within a matter of minutes.

BASIC SYSTEM

103A Laser Head The 103A Laser Head is constructed of a rugged, light weight, cast aluminum housing 2 inches in diameter by 6 inches long. The housing contains the ruby laser crystal, flashlamp, focusing cavity, and trigger transformer. An adapter is provided for forced air or gas cooling where repetition rates exceed one per minute.

This rugged and reliable laser head needs no alignment, and its ruby and flashlamp can easily be removed for maintenance; furthermore, maintenance-free operation is obtained for more than 10,000 cycles.

103A Power Supply The 103A Power Supply furnishes the flash-lamp energy for the laser head as well as the flashlamp excitation voltage. The energy is continuously adjustable from 70 to 230 joules using a front panel control. Excitation voltage is produced by activation of the local or remote trigger switch.

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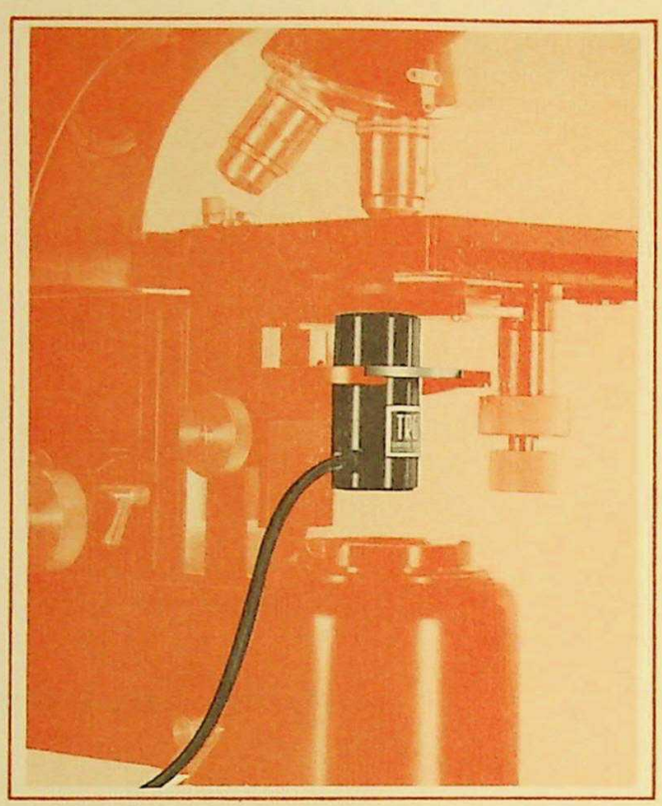
Stage of microscope showing substage monitor for measuring incident energy.



153A Biocoupling The 153A Biocoupling contains the laser head, associated beam-forming optics, and the X-Y controls for coincidence adjustment of the laser spot to the microscope eyepiece reticle.

To produce a beam diameter of 1 micron at the stage of the microscope (see functional diagram of biolaser), the output beam of the laser is focused on a pinhole aperture (P_1) by L_1. The laser-illuminated pinhole serves as the object for L_2, which collimates the beam. The beam is reflected into the microscope eyepiece by a multi-layer dielectric-coated beam splitter. The beam splitter reflects a narrow band of the visible spectrum in the region of the laser output (6943Å) and transmits other wavelengths, thereby permitting simultaneous photography and irradiation of the specimen.

The coupling is supplied with four different aperture sizes which provide a spot size range from 1 to 8 microns when used with a 63 x objective. Larger spot sizes can be produced by varying the objective lens or by removing the pinhole aperture.

Precise alignment of the laser spot with the eyepiece reticle is achieved with two simple external dial adjustments which provide X-Y positioning of the laser spot on the stage.

ACCESSORIES

153A-5 Camera Adapter The Model 153A-5 Camera Adapter has been designed specifically for use with the Bausch & Lomb Model N Eyepiece Camera. The adapter contains the necessary optics and a dichroic filter to prevent scattered laser radiation from overexposing the film.

The Model N Eyepiece Camera Viewing Head (Bausch & Lomb No. 42-16-11) can be attached directly to the TRG 153A-5 camera adapter without modification. Other camera adapters are available on special order.

153A-6 Optical Filter Set The Model 153A-6 Filter Set consists of four calibrated optical filters with nominal transmission values of 1%, 6%, 25%, and 50%. The filters are used to attenuate the laser energy by a known value.

513-4 Safety Interlock The Model 513-4 Safety Interlock prevents the laser from firing while the operator is viewing the stage through the binocular eyepiece. The 513-4 attaches directly to the Leitz triocular Phototube No. FSOIYEE-SINE of the Ortholux microscope. The safety interlock is connected to the 103A Power Supply and prevents the laser from firing when the sliding prism is in the binocular viewing position.

513-5 Substage Energy Monitor The Model 513-5 Substage Energy Monitor is used to measure the laser energy in the focused spot at the stage of the microscope. The 513-5 fits directly into the dovetail slide below the stage of the Ortholux microscope and has a typical sensitivity of 200 microvolts per joule.

102 Energy Meter The Model 102 Energy Meter is a precision transistorized microvoltmeter which is internally calibrated to the 513-5 to read the energy input in joules. The Model 102 can be operated from an AC line or from an internal rechargeable battery (optional).

specifications

LASER HEAD	
Flux Density on Stage:	Up to 10^4 joules/cm^2
Wavelength:	6943Å
Pulse Length:	150 μ seconds
Repetition Rate	
Uncooled:	1 per minute
Cooled:	1 pulse every 30 seconds
Power Output:	0 to 300 millijoules (nominal)
Power Input:	230 joules (max)
Threshold:	150 joules (nominal)
Effective Beam Diameter:	5 mm
Beam Divergence:	10 milliradians (nominal)
Coating:	Multilayer dielectric
POWER SUPPLY	
Input Voltage:	115/220 volts ac $\pm$10% 50-60 cps, single phase
Trigger:	Remote or panel pushbutton
Interconnecting Cables:	a. Line cord supplied b. 6 foot cable and connectors supplied to connect 103A Laser Head to power supply

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ELECTRO-OPTICAL PRODUCTS

1 April 1967

ENERGY AND POWER MEASURING DEVICES

MODEL NUMBER	DESCRIPTION	PRICE
100	Ballistic Thermopile (1 cm aperture).....	$ 385.00
101*	Ballistic Thermopile (1 cm aperture).....	525.00
102	Energy Meter for use with 100/101.....	585.00
107	Ballistic Thermopile (2 cm aperture).....	550.00
108*	Ballistic Thermopile (2 cm aperture).....	690.00
113	Energy Meter for use with 107/108.....	585.00
	*101 and 108 permit oscilloscope observation of laser output in addition to measuring energy output	
105B	Photodetector.....	
	With S-4 Surface.....	1500.00
	With S-1, S-20 or S-1 UV Surface.....	1650.00
105B-1	Optical Filter Set for 105B Photodetector.....	175.00/4 50.00/ea

LASER SYSTEMS

103A	Minilaser - 300 Millijoules.....	
	Consists of: 103A-1 Laser Power Supply.....	1000.00
	103A-2 Laser Head.....	1000.00
104A	Laser System and Accessories Available up to 100 megawatts	
	104A-1 Laser Power Supply.....	2950.00
	104A-2 Laser Head	
	Supplied with Czochralski ruby.....	2090.00
	Supplied with Nd^{+++}doped glass rod.....	1950.00
	104A-3 Rotating Prism Q-switch.....	2200.00
	104A-4 Second Harmonic Generator (Ruby or Nd wavelength).....	950.00
	Additional Second Harmonic Crystal assembly.....	650.00
	104A-5 Bleachable Q-switch.....	750.00
	104A-6 Bleachable Single Pulse Accessory (Ruby)..	500.00
	If the single pulse accessory is purchased as an individual component or is being added to an existing 104A system, the buyer should check with TRG Sales on how to utilize this accessory since higher achievable power densities may cause damage to the laser crystal.	
	104A-7 Base Plate (to aid precise aiming of laser head).....	250.00
	104A-8 Base Plate (to assist alignment of 104A system and 109A Daly-Sims Accessory)....	495.00
	104A-12 Pockel Cell Q-switch.....	5775.00
	104A Laser Bench including laser head mount and collimator mount.....	750.00
	Model 104A Laser System capable of 100 megawatt output.....	8600.00
	Model 104A Laser System capable of 100 megawatt output with beam divergence of less than 3 milliradians.....	9600.00

MODEL NUMBER	DESCRIPTION	PRICE
200B	Laser System 50 megawatt output at 15 pps water cooled.....	19950.00
300	Laser System Series 250 megawatt to 1000 megawatt output with Rep Rates of 2 ppm to 5 pps. The versatility of modular design enables a varied combination of components. Pricing of a particular configuration will be given upon receipt of specifications. The following are typical prices for systems with rotating prism Q-switches:	
301	.....	19950.00
302	.....	24950.00
303	.....	29950.00

LASER ACCESSORIES

109A	Daly-Sims Accessory.....	1500.00
104A-8	Base Plate - to assist alignment of Model 104A Laser System and Model 109A.....	495.00
112	Laser Safety Eyeshields..... (Quantity price breaks upon request)	50.00

BIOLOGICAL LASER SYSTEM

513	*Biolaser System consisting of:	
	103A Minilaser.....	2000.00
	153A Coupling with 513-4 Safety Interlock..... (Specify Microscope with order)	1200.00
	*Available for Leitz Ortholux and Orthoplan and American Optical Series 10 microscopes. Contact TRG for adaptions to any other microscopes.	

BIOLASER ACCESSORIES

153A-5	Camera Adapter including optics and Dichroic Filter (for Leitz Mikas and Bausch and Lomb Model N cameras).....	250.00
153A-6	Optical Filter Set.....	90.00/ set of 4 $25.00/ each
513-5	Substage Energy Monitor..... (use with Model 102 Energy Meter)	325.00

Note: (1) All delivery quotations are subject to prior sale

(2) Prices and specifications are subject to change without notice.

(3) This price list supersedes January 1967 price list and remains in effect until further notice.

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ROUTE 110 • MELVILLE, NEW YORK 11746 • 516/531-0600

Dear Sir:

The enclosed material describes the TRG Model 513 Biolaser in which you were interested. This system is priced at $3200 and is presently available from stock for the Leitz Ortholux microscope with OIYEE trinocular body, the A-O Series 10 Microstar, and the Zeiss GFL and WL camera bodies. We will have an adapter shortly for the A-O cycloptic stero microscopes. Installation of the biocoupler and safety interlock takes only a few minutes and an Allen wrench or screwdriver.

Spot sizes attainable range from one micron with the smallest aperture supplied, in conjunction with a 40 to 63 X objective, at a power of approximately 0.25 millijoule, to 400 microns with no aperture and a 4 to 10 X objective, at a power level of 40-50 millijoules at the stage. In all cases these spots are parfocal with the optical image viewed by the user.

At full input with a specimen which is absorbent of red light the effect ranges from coagulation of protein to complete vaporization of the irradiated area. Also, with fairly large specimens it is possible to drill holes in the cell wall without perforating the opposite wall, or create a thrombus in a blood vessel with little or no damage to out-of-focus areas.

The magnitude of the effect of ruby laser irradiation may be estimated from the degree of absorption of red light of the irradiated area. Typically, retinal tissue is completely destroyed with little or no damage to other tissue in the optical path of the beam; oil droplets often explode and dark nuclei are completely disturbed. Where the area of interest is transparent to red light, vital stains such as Nile blue and Janus green increase absorption even in very weak concentrations.

A number of non-biological applications have been found for the Biolaser. It is suitable for welding fine gold or platinum wires (001 to 005") drilling small holes in fine wires or thin films, and vaporizing microgram quantities of depositied film materials for altering charateristics of resistors, etc. In many cases the ingenuity of a prospective user in adapting the laser characteristics to his requirement have resulted in applications for the instrument.

TRG is always interested in discussing your application and equipment is available for quick-look experiments on your specimens. Where a requirement exists we are prepared to set up a demonstration either in your laboratory or at our plant at your convenience.

We will welcome an opportunity to be of service to you.

Very truly yours,

Herbert Bass

Herbert Bass
Sales Engineer

HB/Mc
Enclosures